

REMARKS

Claims 1, 3-47, 49-51 and 53-55 are pending in this application. By this Amendment, claims 1, 3, 30, 38, 39, 41, 43, 47, 49, 51 and 53 are amended, and claims 2, 48 and 52 are canceled without prejudice to or disclaimer of the subject matter contained therein. No new matter is added.

Applicants appreciate the courtesies extended to Applicants' representative during the February 25, 2004 personal interview. Applicants' separate record of the substance of the interview is incorporated into the foregoing remarks.

It is noted that claims 2-20, 25, 28-30, 35, 36 and 50 have not been rejected under art. Accordingly, Applicants understand these claims contain allowable subject matter. Thus, the allowable subject matter of claim 2 has been included in independent claims 1, 38, 47 and 51.

I. Formal Matters

The Office Action objects to claims 2-20 and 28-30 under 37 C.F.R. §1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. In particular, the Examiner states that claim 2 recites the fuel decomposition is performed by pyrolysis which does not further narrow an apparatus claim. However, Applicants respectfully traverse the objection. In particular, Applicants respectfully submit that there are other methods besides pyrolysis to decompose the hydrocarbon-based fuel (i.e., steam and chemical process). Accordingly, by reciting a pyrolysis process, it is a specific manner in which the fuel decomposition unit must perform that affects the type of reforming apparatus.

Further, it is respectfully submitted that all words in a claim must be considered and examined to determine the patentability of the invention. Thus, reconsideration and withdrawal of the objection are respectfully requested.

The Office Action objects to claims 24, 25, 35, 36 and 50 under 37 C.F.R. §1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. In particular, the Examiner states that claims 24, 25, 35, 36 and 50 recite a type of fuel being utilized, which does not further limit the structure of the apparatus. However, Applicants respectfully submit that the type of fuel does limit the structure of the fuel reforming apparatus. For example, a fuel based on alcohol, benzene, methanol, and methane require different structure to process the fuel. Accordingly, because Applicants' invention recites that the higher hydrocarbon-based fuel is selected from gasoline, naphtha, and light oil, it requires a specific type of reforming apparatus.

Further, it is respectfully submitted that the test for a proper dependent claim is whether the dependent claim includes every limitation of the parent claim. The test is not whether the claim has a different scope, but whether a proper dependent claim shall not conceivably be infringed by anything which would not also infringe the basic claim. MPEP 608.01(n)(II). In other words, the fact that the independent and dependent claims are in different statutory classes does not, in itself, render the latter improper. MPEP 608.01(n)(III). Accordingly, claims 24, 25, 35, 36 and 50 are not in improper dependent form for merely reciting a type of fuel.

Thus, reconsideration and withdrawal of the objection are respectfully requested.

II. The Claims Define Patentable Subject Matter

The Office Action rejects claims 1, 22, 24 and 51 under 35 U.S.C. §102(a) as being anticipated by Christensen et al. (hereinafter "Christensen"), U.S. Patent No. 6,375,916. The rejection is respectfully traversed.

Applicants' claim 1 relates to a fuel reforming apparatus for producing a hydrogen-rich gas from a hydrocarbon-based fuel by means of a reforming reaction. The fuel reforming apparatus includes a fuel decomposition unit configured to decompose a first hydrocarbon-

based fuel into a second hydrocarbon-based fuel with a lower carbon number, the decomposition in the fuel decomposition unit is performed by pyrolysis, and a fuel reforming reactor having a reforming catalyst for promoting a reforming reaction such that the reforming reactor is configured to produce a hydrogen-rich gas from the second hydrocarbon-based fuel by the reforming reaction. By this arrangement, it is possible to reduce formation of soot, and thus increase the efficiency of the reforming reaction in the reforming reactor.

Christensen, on the other hand, discloses a process for preparing hydrogen and/or carbon monoxide rich gas by a catalytic autothermal reforming by passing the hydrocarbon feedstock through a reactor containing steam reforming catalyst to remove or reduce the contents of higher hydrocarbons in the hydrocarbon feedstock, and passing the effluent from the first reactor to an autothermal reformer. Although Christensen discloses a reactor to reduce the contents of higher hydrocarbons in the hydrocarbon feedstock, Christensen fails to disclose or suggest decomposing the first hydrocarbon-based fuel by means of pyrolysis into a second hydrocarbon-based fuel with a lower carbon number. In other words, Applicants' invention discloses the hydrocarbon-based fuel is partially combusted to generate heat, and the remaining hydrocarbon-based fuel is pyrolyzed using the heat produced by the combustion reaction. By this configuration, significant advantages are obtained. For example, decomposing the hydrocarbon-based fuel before feeding it to the reforming reactor makes it possible to prevent situations in which the activity of the reforming reaction is reduced by the absorption of the hydrocarbon-based fuel on the catalytic surface.

Accordingly, Christensen fails to disclose or suggest a fuel decomposition unit configured to decompose a first hydrocarbon-based fuel by means of pyrolysis into a second hydrocarbon-based fuel with a lower carbon number, as recited in claim 1, and similarly recited in claim 51.

Because Christensen does not literally disclose the claimed invention, it cannot provide the basis for rejection under 35 U.S.C. §102. Thus, it is respectfully requested that the rejection be withdrawn.

The Office Action rejects claims 1, 21-23, 26, 27, 31-34, 37-49 and 51-55 under 35 U.S.C. §103(a) as being unpatentable over Clawson et al. (hereinafter "Clawson"), U.S. Patent No. 6,126,908 in view of Acker, U.S. Patent No. 6,322,917. The rejection is respectfully traversed.

The Office Action alleges, on page 5, that Clawson does not disclose either the controller or the decomposition unit. However, the Office Action attempts to overcome the deficiency of Clawson by arguing that Acker discloses the controller and discusses its use.

However, the structure of Acker is different from the structure of the claimed invention. In particular, Acker merely discloses, on page 6 in the Office Action, a partial oxidation reaction zone, which the Examiner contends is the same as the decomposition unit. However, the partial oxidation reaction zone fails to disclose or mention that decomposition is performed by pyrolysis. Accordingly, Acker fails to disclose or suggest a decomposition unit configured to decompose a first hydrocarbon-based fuel by means of pyrolysis into a second hydrocarbon-based fuel with a lower carbon number, as recited in claims 1, 38, 39, 41, 43, 47, 51 and 55.

In regards to claim 54, Clawson and Acker, individually or in combination, fail to disclose or suggest the reforming reaction proceeds on a surface of a reforming catalyst sufficiently active to promote the reforming reaction. Both Clawson and Acker disclose the reforming reaction occurs within the catalyst.

Further, one of ordinary skill in the art would not have been motivated to combine the teachings of Acker with the teachings of Clawson with any expectation of success. That is, nowhere in Acker is there any motivation to modify the disclosure of Clawson in the manner

asserted by the Office Action. In the absence of any motivation to do so, one of ordinary skill in the art would not have combined the references and then modified the resulting combination as asserted in the Office Action to obtain the claimed invention.

Thus, it is respectfully requested that the rejection be withdrawn.

For at least these reasons, Applicants respectfully submit that Christensen, Clawson and Acker, individually or in combination, fail to disclose or render obvious the features recited in independent claims 1, 32, 38, 39, 41, 43, 47, 51, 54 and 55. Claims 3-31, 33-37, 40, 42, 44-46, 49, 50 and 53, which depend from the independent claims, are likewise distinguished over the applied art for at least the reasons discussed, as well as for the additional features they recite. Reconsideration and withdrawal of the rejections are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1, 3-47, 49-51 and 53-55 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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